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(19)

(54) CIRCUIT BOARD PIN

(71) We, E.I. DU PONT DE NEMOURS AND COMPANY, a corporation organized and existing under the laws of the State of Delaware, United States of America, located at Wilmington, State of Delaware, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to circuit board pins adapted to be mounted in holes in a circuit board.

According to the invention, there is provided a circuit board pin for mounting in a circuit board hole, comprising, for engaging the hole, a mounting portion which has a body with two pairs of fins projecting outwardly from its opposite sides and the fins of each pair being adapted to be deformed toward each other upon insertion of the mounting portion into a circuit board hole.

When the pin is seated in the hole, the fins of each pair engage the sides of the hole and bend toward each other thereby securing the pin in the hole. Because of the deformable nature of the fins, any conductive plating provided in the hole is not damaged and any connections between the plating and multi-layer circuitry are preserved. Furthermore, the fins prevent twisting of the pin in the holes during insertion and prior to soldering.

The invention also extends to a circuit board or panel, having fitted into a hole therein, a circuit board pin as above defined.

The invention represents an improvement over circuit board pins of the type disclosed in United States Patents Nos. 2,994,057 and 3,223,960. These patents disclose pins with rigid, non-deformable fins unsuited for mounting in plated circuit board holes. The U.S. Patent No. 3,444,617 discloses another circuit board pin in which the pin rotates as it is pushed into the circuit board hole; clearly this is disadvantageous where the orientation of the pin has to be considered.

The invention and all its objects and advantages will best be understood from consideration of the following detailed description (made with reference to the accompanying drawings) of exemplary embodiments of the invention. In the accompanying drawings:—

Figure 1 is a perspective view of a multilayer circuit board with a number of pins according to the invention mounted therein;

Figure 2 is a side view of the hole-engaging portion of one of the pins of Figure 1;

Figure 3 is a view taken along line 3—3 of Figure 2;

Figure 4 is a sectional view taken along line 4—4 of Figure 2;

Figure 5 is a sectional view (taken along line 5—5 of Figure 6) showing a pin mounted in a plated-through circuit board hole of a multi-layer circuit board;

Figure 6 is a partially broken away sectional view taken along line 6—6 of Figure 5 after solder dipping;

Figure 7 is a sectional view taken along line 7—7 of Figure 6; and

Figure 8 is a sectional view of another embodiment of the invention similar to the section of Figure 4.

Pin 10 is adapted to be mounted in a hole extending into or through the thickness of a circuit board 12 or similar circuit panel. The pin is generally square in cross section and includes a mounting portion 14, which has a body 13 provided with two pairs of adjacent fins 16 projecting outwardly and extending longitudinally along the axis of the pin. Pin sections 18 at either end of portion 14 are square in cross section.

Each fin 16 extends outwardly from one corner of the pin 10. A rounded hole-engaging surface 20 is located on the edge of the fin away from the pin. The surfaces 20 of each pair of fins are located between the axial planes 22 passing through the longitudinal axis 24 of the pin and the pin corners 26 from which the fins extend. Fins 16 extend perpendicularly outwardly of op-

posed opposite pin side walls 28 so that the cross section of the mounting portion 14 is generally H-shaped as illustrated in Figure 4 with the fins forming the legs of the H.

The hole engaging surfaces 20 of fins 16 are located to one side of the planes 22 so that when portion 14 is moved into a circuit board hole and the surfaces 20 engage the sides of the hole, the radial inward forces F exerted on each fin bends the fin toward one pin side 28. If the fins extended radially outwardly of the pin along an axial plane the force exerted upon them during insertion into a circuit board hole would not deform the fins with the result that the fin would dig into the hole and it would injure the plating. Location of the hole-engaging surfaces 20 to one side of the axial planes 22 assures that during insertion the fins are bent and do not injure the plating.

The mounting portion 14 may be formed by a stamping operation. Longitudinal recesses 30 are stamp formed in a portion of a square pin whereby the fins 16 are forced or extruded outwardly. This operation work hardens the fins to provide an improved spring property. As shown in Figure 2 the fins 16 are shaped to provide a tapered lead-in in order to facilitate moving portion 14 into a circuit board hole.

Portions 18 of the pin 10 extend freely into plated circuit board hole 32 extending through the thickness of multi-layer circuit board 12. The hole-engaging surfaces 20 of fins 16, however, have a greater radius distance from axis 24 which is greater than the radius of hole 32. The pin 10 is positioned in the hole 32 by freely moving one portion 18 therethrough and then inserting portion 14 in the hole. As the portion 14 is moved into the hole, surfaces 20 are brought into engagement with the plating in the hole. With further insertion of the pin each fin 16 is bent toward the adjacent fin. The work hardened fins are thus collapsed toward each other so that the pin is securely held in the hole 32. The deformable fins permit mounting pin 10 in circuit board holes of different diameter. This feature is important because it is difficult to assure that a number of circuit board holes are of the same diameter.

Insertion of pins 10 with deformable fins does not injure the plating in the holes 32. Thus the pins 10 are inserted into the holes in the circuit board 12 without impairing the electrical connections in the plated hole. This is particularly important in the case of circuit boards having internal conductive layers 34 with electrical connections formed between the layers 34 and plating in the circuit board holes. The insertion of conventional press fit type pins into plated holes may rupture the plating and injure the electrical connections between the internal circuitry 34 and the plating in the hole.

The pin is not rotated during insertion because the fins in each pair of fins deform toward each other. The pin 10 may be picked up by insertion tooling in a given angular orientation and then mounted on a circuit board in the same orientation to ensure that the flat surfaces of sections 18 are properly aligned as required by the usage of board 12 when completely assembled. As an example, the angular orientation of the pins is important in the case where disconnectable terminals are attached.

Figure 5 illustrates a pin 10 which has been seated in the plated hole 32 through circuit board 12. Fins 16 have been partially collapsed and engage the sides of the plated hole. After the pin 10 is seated in the board the connection is soldered, either by hand or by a conventional type soldering method, in order to provide an electrical connection 36 between the pin and plated circuitry on board 12. Molten solder is applied to the pin at one side of the circuit board and flows along the four solder flow channels 38 to the other side of the board. Recesses 30 contribute to channels 38 and improve the solder flow through the circuit board hole 32.

Figure 8 illustrates a modified pin 39 in which adjacent fins 40 are bent toward each other. This provides a somewhat more resilient connection between the pin and the circuit board hole by moving the hole-engaging surfaces 42 further away from the axial planes 44 passing through corners 46 than in the case of the pin 10 in which the fins 16 extend perpendicularly outwardly of the pin side walls 28. With the exception of the bent fins 42 pin 39 is identical to pin 10.

While the pins 10 and 39 disclosed herein are both generally rectangular in cross section, it will be appreciated that the pins may be cylindrical or of any other cross sections in which it is desired to mount the pins in circuit board holes. The invention is particularly useful in connection with mounting circuit board pins in plated circuit board holes, however it may be used in connection with mounting pins in circuit board holes which are not plated.

While there have been described and illustrated preferred embodiments of this invention, it is understood that these are capable of modification. Accordingly therefore, the precise details set forth herein are not to be regarded as limiting but merely as exemplary of the scope of this invention as defined by the following claims.

WHAT WE CLAIM IS:—

1. A circuit board pin for mounting in a circuit board hole, comprising for engaging the hole a mounting portion which has a body with two pairs of fins projecting out-

wardly from its opposite sides and the fins of each pair being adapted to be deformed toward each other upon insertion of the mounting portion into a circuit board hole.

2. A circuit board pin as claimed in Claim 1, wherein, the mounting portion for engaging the hole is substantially of a H-shape cross section, the legs at each end of the H-shape cross section being formed by a pair of fins deformable toward one another.

3. A circuit board pin as claimed in Claim 1 or 2, wherein the mounting portion has a body of generally rectangular cross-section and the fins extend from adjacent corners of said rectangular cross-section.

4. A circuit board pin as claimed in Claim 3, wherein each pair of fins extends perpendicularly away from opposite sides of said rectangular cross-section.

5. A circuit board pin as claimed in Claim 3 wherein the fins of each pair extend towards each other so that the distance between the outermost extremities of each pair of fins is less than the distance between said corners.

6. A circuit board pin as claimed in any of the preceding claims formed with at least one longitudinally extending recess in the mounting portion thereof, said recess serving for facilitating flow of solder into a circuit board hole into which the pin is fitted.

7. A circuit board pin as claimed in any of the preceding claims wherein the fins extend longitudinally with respect to the axis of the pin and wherein the distance of the free edges of the fins from the body changes throughout at least part of their longitudinal extent to provide a tapered lead-in to facilitate insertion of the pin into a circuit board hole.

8. A circuit board pin substantially as herein described with reference to Figures 2 to 4 of the accompanying drawings.

9. A circuit board pin substantially as herein described with reference to Figure 8 of the accompanying drawings.

10. A circuit board or panel having, fitted into a hole therein, a circuit board pin as claimed in any of the preceding claims.

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1426264 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig. 1

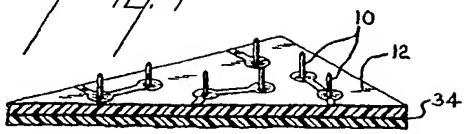

Fig. 2

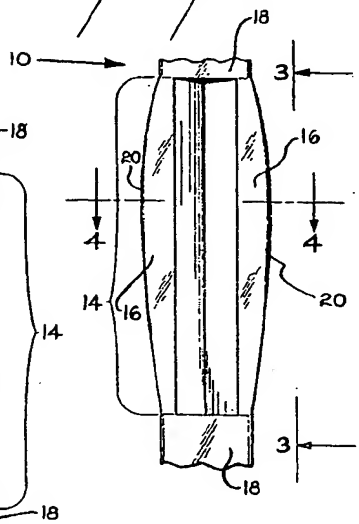

Fig. 3

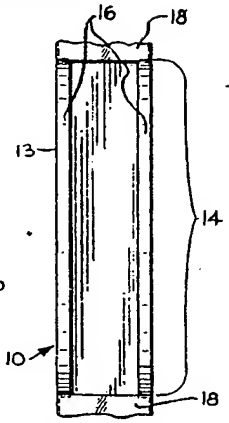

Fig. 4

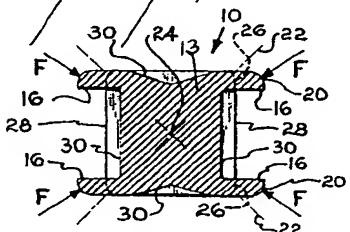

Fig. 5

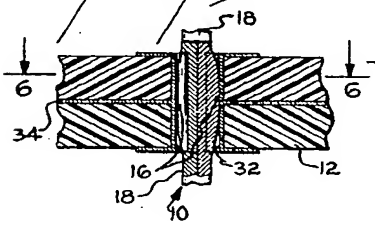

Fig. 7

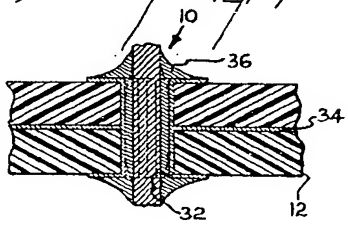

Fig. 6

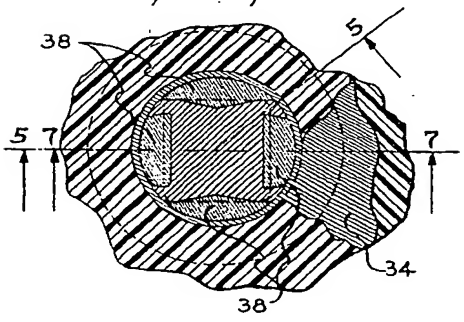

Fig. 8